

89 Rec'd PCT/PTO 06 MAY 1997

254 865 #3

IN THE UNITED STATES DESIGNATED/ELECTED OFFICE
(DO/EO/US)

Applicant: Pietro Padovani,

Re: RESPONSE TO NOTICE
OF MISSING REQUIREMENTS
UNDER 35 U.S.C. 371 IN THE
STATES DESIGNATED/ELECTED
OFFICE (DO/EO/US)

Serial No.: 08/809,340

Group: Not yet assigned

INTERNATIONAL APPLN. NO.
PCT/EP95/03451

I.A. FILING DATE: 09/01/95

Our Ref: B-3289 PCT 615920-5

For: "THERMOFORMING APPARATUS
FOR THERMOFORMABLE MATERIALS
IN RIBBON OR SHEET-FORM"

Date: May 6, 1997

Hon. Commissioner of Patents and Trademarks
Box PCT
Washington, D.C. 20231

Att: DO/EO/US

Ms. Wonda M. Wallace, Paralegal Specialist

Dear Ms. Wallace:

In response to the Notice of Missing Requirements Under 35 U.S.C. 371 in the United States Designated/Elected Office (DO/EO/US) dated 04/23/97 (copy attached), please find enclosed the following:

1. Declaration/Power of the inventors, identifying the application by International application number and International filing date;
2. Check in the amount of \$65.00 to cover the surcharge for providing the oath or declaration later than the appropriate 20 or 30 months from the priority date (37 CFR 1.492(e));
3. Verified Statements that this filing is by a small entity; and
4. Request for Refund.

529 KD 05/30/97 08849340
1 254 65.00 CK

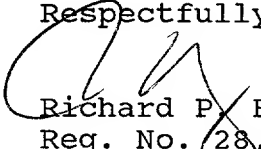
269050-0460800

AUTHORIZATION TO CHARGE ADDITIONAL FEES

[X] The Commissioner is hereby authorized to charge the following additional fees which may be required to Account No. 12-0415.

- [X] 37 CFR 1.16 (filing fees and presentation of extra claims)
[X] 37 CFR 1.17 (application processing fees)
[] 37 CFR 1.18 (issue fee at or before mailing of Notice of Allowance, pursuant to 37 CFR 1.311(b)).

Respectfully submitted,


Richard P. Berg
Reg. No. 28,145
Attorney for Applicant

LADAS & PARRY
5670 Wilshire Boulevard, #2100
Los Angeles, California 90036
(213) 934-2300

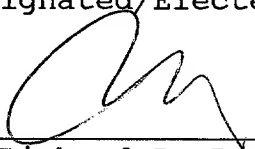
CERTIFICATION UNDER 37 CFR 1.10

I hereby certify that this paper and the documents referred to as enclosed therein are being deposited with the United States Postal Service on this date May 6, 1997 in an envelope as "Express Mail Post Office to Addressee" Mailing Label Number EM177209455US addressed to the:

Commissioner of Patents and Trademarks
BOX PCT
Washington, D.C. 20231

Att: United States Designated/Elected Office (DO/EO/US)

Date: May 6, 1997


Richard P. Berg

Rec'd PCT/PTO 12 MAR 1997

FORM PTO-1390
(REV 10-93)

U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

ATTORNEY'S DOCKET NUMBER

**TRANSMITTAL LETTER TO THE UNITED STATES
DESIGNATED/ELECTED OFFICE (DO/EO/US)
CONCERNING A FILING UNDER 35 U.S.C. 371**

B-3289PCT-615920-5

U.S. APPLICATION NO. (If known, see 37 CFR 1.5)

08/809340

INTERNATIONAL APPLICATION NO.

PCT/EP95/03451

INTERNATIONAL FILING DATE

01 September 1995

PRIORITY DATE CLAIMED

14 September 1994

TITLE OF INVENTION**"THERMOFORMING APPARATUS FOR THERMOFORMABLE MATERIALS IN RIBBON OR SHEET-FORM"****APPLICANT(S) FOR DO/EO/US**

PADOVANI, Pietro

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☐ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
 - a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☐ has been transmitted by the International Bureau.
 - c. ☒ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☐ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
 - a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☐ have been transmitted by the International Bureau.
 - c. ☐ have not been made; however, the time limit for making such amendemnts has NOT expired.
 - d. ☒ have not been made and will not be made.
8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4))— will be filed belatedly.
10. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern document(s) or information included:

11. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☒ A **FIRST** preliminary amendment. deleting multiple dependent claims
☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
14. ☐ A substitute specification.
15. ☐ A change of power of attorney and/or address letter.
16. ☒ Other items or information:
 copy of PCT/IB/308
 copy of published PCT application
 copy of Chapter II Demand
 copy of Written Opinion
 copy of Response to Written Opinion
 copy of International Preliminary Examination Report
 copy of International Search Report (see Information Disclosure Statement)

PCT/EP95/03451

B-3289PCT 615920-5

17. ☒ The following fees are submitted:**BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)):**

Search Report has been prepared by the EPO or JPO \$910.00

International preliminary examination fee paid to USPTO (37 CFR 1.482)

..... \$700.00

No international preliminary examination fee paid to USPTO (37 CFR 1.482)
but international search fee paid to USPTO (37 CFR 1.445(a)(2)) \$770.00Neither international preliminary examination fee (37 CFR 1.482) nor
international search fee (37 CFR 1.445(a)(2)) paid to USPTO \$1,040.00International preliminary examination fee paid to USPTO (37 CFR 1.482)
and all claims satisfied provisions of PCT Article 33(2)-(4) \$96.00**ENTER APPROPRIATE BASIC FEE AMOUNT =****CALCULATIONS PTO USE ONLY**

\$ 910.00

Surcharge of \$130.00 for furnishing the oath or declaration later than ☐ 20 ☐ 30
months from the earliest claimed priority date (37 CFR 1.492(e)).

\$

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE
Total claims	24 - 20 =	4	X \$22.00
Independent claims	1 - 3 =	0	X \$80.00
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ \$250.00
			0

\$ 88.00

\$ 0

\$ 0

~~Preliminary Amendment~~
~~deleting multiple~~
~~dependent claims enclosed~~
Reduction of 1/2 for filing by small entity, if applicable. Verified Small Entity Statement
must also be filed (Note 37 CFR 1.9, 1.27, 1.28).

TOTAL OF ABOVE CALCULATIONS =

\$

SUBTOTAL =

\$ 998.00

Processing fee of \$130.00 for furnishing the English translation later than ☐ 20 ☐ 30
months from the earliest claimed priority date (37 CFR 1.492(f)).

\$

TOTAL NATIONAL FEE =

\$ 998.00

Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be
accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property

\$

TOTAL FEES ENCLOSED =

\$ 998.00

Amount to be:
refunded

\$

charged

\$

a. ☒ A check in the amount of \$ 998.00 to cover the above fees is enclosed.b. ☐ Please charge my Deposit Account No. _____ in the amount of \$ _____ to cover the above fees.
A duplicate copy of this sheet is enclosed.c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any
overpayment to Deposit Account No. 12-0415. A duplicate copy of this sheet is enclosed.**NOTE:** Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

LADAS & PARRY
5670 Wilshire Boulevard, #2100
Los Angeles, California 90036-5679
Telephone No.: (213) 934-2300
Telefax No.: (213) 934-0202

SIGNATURE:

Richard P. Berg

NAME

28,145

REGISTRATION NUMBER

Rec'd PCT/PTO 12 MAR 1997
08/809340

EXPRESS MAIL EM407570175US

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Pietro Padovani

Re: Preliminary Amendment

Serial No.:

Our Ref: B-3289PCT 615920-5

Filed Concurrently herewith

Date: March 12, 1997

International Appln. No.
PCT/EP95/03451

International Filing Date:
01 September 1995

For: "THERMOFORMING APPARATUS
FOR THERMOFORMABLE MATERIALS
IN RIBBON OR SHEET-FORM"

Hon. Commissioner of Patents and
Trademarks
Box PCT
Washington, D.C. 20231

Sir:

Prior to examination of the above-identified application, it is respectfully requested that the following amendments be made to the claims:

IN THE CLAIMS

Claim 6, line 1

Please delete "or 2".

Claim 10, lines 1 & 2

Please change "in any of Claims 6
to 9" to Claim 6--.

- Claim 14, lines 1 & 2 Please change "any of Claims 10 to 13" to --Claim 10--.
- Claim 15, lines 1 & 2 Please change "any of Claims 6 to 9" to --Claim 6--.
- Claim 16, lines 1 & 2 Please change "any of Claims 6 to 9" to --Claim 6--.
- Claim 17, lines 1 & 2 Please change "any of Claims 6 to 9" to Claim 6--.
- Claim 19, lines 1 & 2 Please change "any of Claims 6 to 9" to --Claim 6--.
- Claim 20, lines 1 & 2 Please change "any of Claims 6 to 9" to --Claim 6--.
- Claim 22, lines 1 & 2 Please change "any one of Claims 6 to 9" to --Claim 6--.
- Claim 23, lines 1 & 2 Please change "any of Claims 6 to 9" to -- Claim 6--.

269050-01260220

[illegible]

REMARKS

Respectfully submitted,


Richard P. B.

LADAS & PARRY
5670 Wilshire Boulevard,
#2100
Los Angeles, California 90036
(213) 934-2300

59 Rec'd PCT/PTO 12 MAR 1997

"THERMOFORMING APPARATUS FOR THERMOFORMABLE
MATERIALS IN RIBBON OR SHEET-FORM"

DESCRIPTION

5

This invention generally relates to a thermoforming apparatus for thermoformable materials in ribbon or sheet-form.

10

As is known in the art - see for example the patents of Applicant n°1 175 178 and n°1 218 634 - it has already been suggested to extract mouldings of thermoformed objects from a female die by using suction plates which are introduced between the male die and the female die of a thermoforming machine and then successively move away from the moulding area to deposit the articles onto an extracting or removal means for a series of intervening operations on the articles, such as stacking, labelling, etc.

15

20

Also already proposed has been a thermoforming machine with a double female die arranged to be actuated in alternate transverse motion in relation to a male die, in which two suction hoods alternately extract a thermoformed-article moulding from a respective female die, to transfer it in sequence to a perforated jig forming part of a step conveyor having a plurality of jigs, each of which has holes dimensioned and arranged like the female cavities of the female dies where the articles were thermoformed. The conveyor is operatively connected to the thermoforming machine and moves at the pace of the operating rate of the thermoforming machine, and is intended to receive the articles immediately after the thermoforming process, to support them in the same reciprocal set as they occupied in female die, in order to prolong the time for the stabilisation of the material just thermoformed and allow the regular feeding of the thermoformed articles to a series of operating stations for intervention on the articles. Reference should be made to applicant's Italian patent application no 92A000012 filed 3 February 1992 and entitled: "Process and apparatus for the thermoforming and stacking of

25

30

35

- 2 -

hollow bottom-provided articles obtained from a ribbon of thermoplastic material".

US patent 4 464 329 (Whiteside et al) discloses a thermoforming machine in which the plates of a plate-conveyor pass between a male die and a female die and are pressed between the two dies during the closure phase of the die and co-operate with an intermediate auxiliary die, which is mobile in relation to the female die. Each plate or jig is fitted with receiving seat for a moulded article and around the peripheral contour of such seat is provided a ring gasket of flexible material which serves to resiliently engage and keep the thermoformed article restrained in its position whether during the extraction of the article from the female die or during its transfer to an unloading station or removal from the conveyor.

The solutions proposed up to now, although satisfactory from many points of view, have not provided for the thermoformed article or articles to be held fast to a receiving template or jig forming part of the step conveyor operatively connected to the thermoforming machine, in which case, the thermoformed and not yet stabilized articles can undergo inertial shifting or removal from their reception seats, whereby they can lose the required precision of their positioning for successive operations or interventions on them.

It can be seen, in fact, in Figures 1 to 6 in the accompanying drawings show a truncated conical container with protruding rim such as a beaker 1, deposited in two different seats (through-holes) 2 and 3 (which latter is fitted with a peripheral recess 3a against which the rim 1a of the container can abut provided in a respective transfer plate or jig 4 and 5. As each plate or jig is speedily moved at the pace of the rate of operation of the thermoforming machine which produces the articles, the articles in the jig are repeatedly subjected to acceleration both while being moved forwards and stopped. Since the centre of gravity G of each article 1 is outside the plane of the lying position of the jigs 4 and 5, whenever the

- 3 -

article undergoes an acceleration, it also undergoes an upturning momentum which tends to make the article tilt in relation to the vertical in proportion to the arm bG (Figs. 1 and 4). In view of the taper (angle α - Fig. 2 and 5), such momentum can also give rise to a harmful banging either on the lateral wall of the container 1 in the process of stabilisation, or on its rim (Figs. 3 and 6) as also to undesirable bedding outside the axis, which almost always compromise the good result of successive operations and interventions on the container which must maintain a correct, unvarying set, either during the step- by-step transfer or while stationed at the various work stations.

In the case of the solution suggested in US patent 4 464 329, the extraction operations of the die are not kept separate from the positioning operation of the transfer plate or jig, the reason why recourse must be made to a three-piece die (male, female and auxiliary intermediate die) extremely complicated and costly to make and mobilize. Moreover, in the Whiteside et al. solution, during the moulding phase, the ring gasket is kept in contact with the hot edges of the thermoforming die, and thus the gasket is subjected to repeated thermal cycling, undergoes rapid ageing and loss of flexibility, and after a limited number of thermoforming cycles, can stiffen until it causes scoring or another form of damage to an article which has just come out of the thermoforming die and is not yet fully stabilized, and thus undoubtedly increasing the number of rejects (unless special and consequently very expensive material is used).

The main object of the present invention is to eliminate or drastically reduce the drawbacks often complained of in the thermoforming apparatus, thereby allowing either a rapid extraction of the thermoformed articles from the die or seating them in a stable set on templates or jig for successive removal and transfer to one or more treatment and/or work stations.

Another object of the present invention is to provide available a thermoforming apparatus fitted with a step

conveyor with templates or jigs for receiving the articles just extracted from the thermoforming dies and in the process of stabilisation, to enable them to be transferred to a plurality of work stations, while keeping their set intact.

These and further objects, which will become more apparent later, are achieved with a thermoforming apparatus comprising a thermoforming machine fitted with at least one female die and counter-die or male die reciprocally approachable and removable for the operations of closing, thermoforming and opening, a feeder suitable for feeding thermoforming material in ribbon or plate form between each die and counter-die, cutting means associated with the die and counter-die for cutting the ribbon or plate material immediately after the closure of the die and counter-die, at least one work or treatment station for the articles thermoformed in the or each die and counter-die, a plurality of extraction means to extract a thermo-formed article moulding from the female die and move away from the die to convey the extracted articles successively to the or each work or treatment station, or else to transfer it to a receiving template for being conveyed to the or each work or treatment station or stations, retention means suitable for engaging each thermoformed article with the respective extraction head or else to its respective receiving template, thus ensuring its positioning in the correct set during conveyance through the work or treatment station or stations.

Further aspects and advantages of the present invention will become more apparent from the following detailed description of some of the currently preferred embodiments thereof, given by way of indicative, although not exclusive examples only, with reference to Figures 7 to 53 of the accompanying drawings, in which:

Figure 7 is a schematic lateral elevation of a thermoforming machine provided with an extraction plate for the thermoformed articles and with an alternately moving conveyor having two coplanar templates;

Figure 8 is a partial top view of the female die of the thermoforming machine, the conveyor and the extraction plate of Fig. 7;

Figure 9 is a top view illustrating a carousel variant with four arms;

Figure 10 shows in schematic section and lateral elevation view a thermoforming machine fitted with extraction plate for thermoformed articles and with a chain conveyor (with despatch and return runs, parallel but moving in opposite direction) fitted with article receiving templates, moving in sequence, first in one direction (forward run) and then in the other (return run);

Figure 11 illustrates a partial top view of the female die of the thermoforming machine, the conveyor and the extraction plate of Fig. 10;

Figures 12 and 13 are, respectively, a lateral elevation view and a top section similar to those of Figures 10 and 11, but with a conveyor with templates mounted and trailed along two circular, coaxial and coplanar trackways;

Figures 14 and 15 are, respectively, a lateral elevation view and a top section similar to those in Figures 10 and 11, but with a carousel conveyor with three plates or templates which act either as extraction plates for the die or as conveyor;

Figure 16 shows a detail of a receiving seat for a thermoformed-article, provided in a template;

Figure 17 is a schematic front elevation view which illustrates a thermoforming machine with conveyor with templates mounted on chains, where the conveyor templates also act as extraction plates for the articles thermoformed by the die;

Figure 18 shows a detail in a magnified-scale of the conveyor template of Fig 17;

Figure 19 is a partial sectional view of a conveyor template with seat provided with retention collar and container seated therein;

Figure 20 illustrates a detail of the template of Fig 19 to an enlarged scale;

Figure 21 illustrates a partial sectional view of another conveyor template similar to that in Fig. 19, but also formed with an annular recess for receiving the rim of the container;

5 Figure 22 illustrates a detail in section and to an enlarged scale of Fig 21;

Figures 23 and 24 are top views illustrating possible shapes in circular, rectangular or quadrate topview of the container of Figures 19 and 21;

10 Figure 25 is a local sectional view which shows another embodiment of a template seat for thermoformed articles;

Figure 26 shows a sectional detail of Fig.25;

Figure 27 shows a sectional view of a further embodiment of a seat for a receiving template for thermoformed
15 articles;

Figure 28 illustrates a detail of Fig. 27;

Figure 29 is a sectional view showing a template with a receiving seat provided with an adapter collar for retaining the container;

20 Figure 30 shows a detail of Fig. 29;

Figure 31 and 33 and the respective details of Figures 32 and 34, illustrate two embodiments of a conveyor template fitted with resilient means of restraint for thermoformed articles;

25 Figure 35 illustrates a partial sectional view of a receiving seat for a thermoformed article in a conveyor template with vacuum retention means;

Figure 36 shows a variant of Fig. 35;

30 Figure 37 is a sectional view showing a receiving seat of thermoformed articles fitted with resilient retention means;

Figure 38 shows a modification of Fig. 37;

Figures 39 and 40 are topviews illustrating a circular and a rectangular shape of thermoformed article of Figures 37 and 38;

35 Figure 41 shows a partial sectional view of another embodiment of a receiving seat for thermoformed articles of a conveyor template provided with mechanical retention means;

Figures 42 and 43 show details and variants of the plate or template of Fig. 41;

Figures 44 and 45 are topviews illustrating a circular and a rectangular shape of thermoformed article installable in the plates of Figures 41 to 43;

Figures 46 and 47 show two jig seats for a template conveyor slat for thermoformed articles with pneumatic means for retention in position;

Figures 48 and 49 show two partial sectional views of two different embodiments of a receiving seat for a thermoformed cover in a conveyor template;

Figure 50 shows a receiving seat of a conveyor template comprising a raised push rod;

Figure 51 shows a partial sectional view of a receiving seat with bearing recess for the rim of a thermoformed article;

Figure 52 illustrates a partial sectional view of a receiving seat in a conveyor template for thermoformed articles; and

Figure 53 shows a variant of Fig. 52.

In the accompanying drawings, the same or similar parts or components have been marked with the same reference numerals.

With reference first to the embodiment illustrated in Figures 7 and 8, schematically indicated by 10 is a thermoforming apparatus which comprises a base 11 on which is mounted a vertically mobile female die 12. Above the female die 12 there is provided, as is usual in thermoforming technology, a male die or counter-die 13, which in its turn, can be lowered and raised in relation to the female die and synchronously with it, to allow implementation of the required operations of closing and opening of the die, as well as cutting of the thermoformable material in ribbon or plate 14 being supplied by any suitable means between the dies 12 and 13 when they are in the open position.

The articles 15 (usually containers - beakers, cups, basins, lids and the like) obtained by thermoforming within

the female die 12, after the opening or reciprocal removal of the dies 12 and 13, must be withdrawn from the female die, which operation being facilitated by the provision of the extraction members E (one for each thermoformed article) rising from the base of the female die during the opening phase of the dies. The articles are detached from the die 12 using an extraction plate 16, for example, a suction plate as described in Italian patent no 1 175 178 and no 1 218 634 referred to above, which is actuated in phase with the removal rate of the dies 12 and 13 and extracts all the moulding articles present in the female die 12 and transfers them onto a jig or template 17 fitted with so many reception seats of holes 18, equivalent in number to the articles 15 constituting a moulding.

The templates 17 belong to a conveyor 19 with two templates alternately movable, once onto one side of the die 12 and once onto the other, so that a template is moved laterally in relation to the female die, while the other is in front of it ready to receive an article moulding from the extraction plate 16. In their lateral position, the templates 17 deliver the articles 15 to a handling and/or treatment station, for example, a sterilisation and stacking station for the articles.

The embodiment of Figure 9 relates to a carousel conveyor 20 comprising of four templates 17 positioned at 90° angles, to revolve in a pre-set direction of rotation for sequential positioning under extraction plate 16, to receive from it a moulding of articles 15 to be transferred.

Figures 10 and 11 illustrate an embodiment in which the templates 17 are positioned under a step conveyor 24 comprising two chains 25 which turn around respective chain wheels 26 at the ends of the conveyor and spanning which are mounted a plurality of templates 17 which are then arranged in an upper run 27 immediately below the operating path of the extraction plate 16 and a lower one 28, which moves in the opposite direction to the upper one. There can be provided a multiplicity of work and/or handling stations for the articles 15 arranged on the templates alongside the

conveyor 25 both along its upper run 27 and its lower run as well as at end wheels 26.

The variant shown in Figures 12 and 13 concerns a conveyor 29 comprising a single run, level but circular in shape, suitable for moving a plurality of templates 17 in sequence making them revolve stepwise, all in the same direction, under the extraction plate 16.

If desired, each template 17 can be easily mounted on a pair of fixed, circular, lateral trackways 30 and 31, for example, by means of two slides or carriages, respectively 32 and 33, and is restrained, typically by cable or chain or a suitable linkage means 34, either to the template preceding it or to the one following it on the circular conveyor 29. The template train is of course drawn in rotation by a step motor at a pace which will make the various templates stand in turn under the extraction plate 16.

The embodiment shown in Figures 14 to 16 relates to a carousel conveyor 35 with three arms 36, 120° apart, each of which supports an extraction plate 16 at its end. Each extraction plate 16, therefore, sequentially moves into three different operating positions, that is to say, one for extraction from between the opened dies 12 and 13, an intermediate one, where for example, the articles 15 are labelled or bored or otherwise processed or machined at a particular work station (not shown in the drawings), and a terminal (all positioned along the path of the extraction plate 16), where the same articles 15 are, for example, stacked in a stacking unit SA similar to that of Fig. 7.

As can be seen looking at Figure 16, the extraction plates 16 can also be of a different type from the suction one and can have receiving holes 16a machined along their thickness in order to present two annular inclined-plane surfaces 16a and 16b which delimit between them an equatorial shoulder 16d with an internal angle slightly undercut to be able to engage and firmly hold in position the free rim of a respective article 15.

The latter, while being raised by the extractor members E, is pushed to slide with its rim along the tapered surface 16b and to snap into engagement position with the shoulder 16d, and then conveyed along the operation path comprising the intermediate and the final station for the respective extraction plate 16. When at the final station, a slight thrust on the base of the container by a suitable thrusting device SP. (Fig. 14) will free the container from its receiving seat to then move to the stacker unit SA.

A similar structure is that illustrated in Figures 17 and 18, in which a plurality of extraction plates such as those in Figures 14 to 16 are mounted on a chain conveyor 37 of the type of conveyor 24, in which a run, for example, the upper run, extends between the dies 12 and 13 when they are in the open position and carries in step sequence the various plates 16, to be loaded with articles which are then carried in sequence to a predetermined number of work or handling stations.

Figures 19 to 24 illustrate a template 17, which, at each receiving hole 18 has in its far surface far from the extraction plate 16 a tapered collar 38, in which the articles 15 can precisely fall into seated position where they can thus abut with their rim either directly against the other surface of the template (Figs 19 and 20) or with a suitable annular recess 39, which assists in providing greater stability and accuracy in holding the articles 15 of both circular and square or rectangular topview configuration in the correct set.

As can be seen, in fact, the upturning momentum due to the arm bG and the inertial force at the centre of gravity G of the articles 15 is completely neutralized by shape engagement provided by the collar 38 and the thickness of the template having a total height h. In its turn, the height h is determined as a function of both the shape of the article 15 and the clearance g between the wall of the article and the internal diameter of the respective receiving seat 16a.

The embodiment shown in figures 25 and 26 concerns an adaptor collar 39 installable in each two-diameter receiving hole 18 a template 17 and having an internal diameter delimited by a higher tapered section 40, by an undercut intermediate section 41 with a negative angle α , for example, from 3° to 10°, preferably, of approximately 5°, by an annular shouldering 42 at the undercut section, followed by a cylindrical end section 41. The articles 15 released by an extraction plate 16 are placed between a respective collar 39 and at their rim, slide along the tapered section 40 until they snap engage with the tapered section 40, in which they remain "resiliently constrained" in the correct position.

The templates 17 of Figures 27 to 30 have holes 18 fitted with a receiving tapered upper portion 44 and connected lower portion 45, but with an internal diameter slightly smaller than the external dimensions of the article 15 in the proximity of its rim. Also, in this case, the article 15 is "resiliently constrained" and therefore settled in stable fashion within the respective receiving hole, from which it can be upturned solely by the exercise of a sufficient thrust from below upwards.

Since there is no clearance g between the internal diameter of the receiving seat 18 in the template 17 and walls of the article 15, it is not necessary to provide any collar means to increase the thickness of the template 17.

The embodiment of Figures 31 to 34 is similar to those of Figures 19 to 22, except that the lower part 46 of the collar 38 consists of a deformable resilient material, suitably anchored to the collar and designed to exert a moderate pressure on the external surface of the article.

Figures 35 and 36 show holes for a vacuum pneumatic circuit (not shown and communicating with a suitable suction means) formed in the collar 38 and having the function of maintaining the thermoformed articles 15 in a stable set.

Figures 37 and 38 illustrate suitably shaped ratchets 48 installed in a collar 38 fitted at a preset distance from the template 17, in order to be able to move radially or

otherwise along a transverse plane (preferably perpendicular) with respect to the axis of the respective article 15 to be locked in position. The ratchets 48 are resiliently loaded, for example, by one or more springs 49.

5 Figures 39 to 45 show eccentric mechanical retainers 50, each of which is mounted at a respective receiving hole 18 on a template 17, and is movable, for example, by rotation around an axis normal to the template 17 to which it belongs, between an operating position in which it engages
10 the rim of an article 15 and an inoperative release position. Actuation of the retainers 50 can be effected by means of a rack operated by a suitable motion source, such as a pneumatic jack, and an integral pinion 52 in rotation with a respective retainer 50.

15 Embodiment examples of Figures 46 and 47 concern retention means, generating air-jets 53 through a manifold CL, which exert a thrust pressure on the article 15 in correct set in the respective receiving seat 18 and with their rim abutting against the template 17.

20 Means of retention in position for covers 15 are illustrated in Figures 48 and 49 and comprise a bearing shouldering 57 in each receiving seat 18, which has two diameters, or else an annular protrusion 59 which engages the internal diameter of the flange 60 of the cover (Fig.
25 49).

 Figures 50 and 51 show retention means for articles 15 kept inverted during transfer to the various work or treatment stations. Figure 50 illustrates a sort of push rod 61 which rises from a surface of the templates 17 at a
30 dummy receiving seat 18a, while in Figure 51 the dummy receiving holes 18 annular slots 62 are provided, with which the free rim of an inverted article 15 will abut. The removal is effected, for example, by means of a push rod 56.

 Figures 52 and 53 illustrate cup retention means 54 with
35 an orifice 55 at the base. The cup 54 is applied in similar way to a collar 38, to correspond with each receiving hole 18 of a template 17 for receiving and completely compassing an article 15 (even if not provided with a flanged or curled

rim), thus preventing any lateral shift, but with the possibility of easily expelling it from the cup 54 by acting with a push rod 56 through the orifice 55.

5 As will be seen with the technical solution, in
accordance with the present invention a sure, steady,
uniform positioning of the articles for an indefinite series
of mouldings is ensured, so that on the same articles while
they are in the process of stabilization, a certain number
of finishing and/or embellishment operations with great
10 precision and without turning out rejects.

The invention described above is susceptible to numerous
modifications and variations within the protective scope of
defined by the purview of the claims.

0000940 030349
463050 0460800

Claims

1 A thermoforming apparatus comprising

- a thermoforming machine (10) fitted with at least one female die (12) and counter-die or male die (13) reciprocally approachable and removable for the operations of closing, thermoforming and opening, a feeder appropriate for feeding thermoforming material in ribbon or plate (14) from between each female die (12) and counter-die (13),
- cutting means associated with the die and counter-die for cutting the ribbon or plate material, immediately after the closure of the die (12) and counter-die (13),
- at least one work or treatment station for articles (15) thermoformed in the or each die (12) or counter-die (13),
- extraction pick-up means (16) designed to withdraw a thermoformed article moulding from the female die (12) and either to convey the same to at least one work or treatment station or to transfer it to a receiving conveying template (17) which has the same seating configuration as that of the female die (12) and is arranged to move the thermoformed articles (15) past at least one work or treatment station,
- **characterised in that** retention means are provided in the said extraction pick-up means and/or in the said receiving conveying template to hold them in position against undesired movement therein.

2. A thermoforming apparatus as claimed in Claim 1, characterised in that the said pick-up extraction means comprises a plate-like head (16) arranged to be sequentially inserted between the or each female die (12) and counter-die (13) concomitantly with each opening of the same.

3. A thermoforming apparatus as claimed in Claim 2, characterised in that it comprises a carousel conveyor (20) with a plurality of bearing arms, each of which supports a respective plate-like head (17) fitted with said retention means for the retention of the thermoformed articles (15) in the correct set while they are being conveyed, stepwise and synchronously with the opening-closing rate of the dies

(12), through the work or treatment station or stations, positioned around the carousel conveyor.

4. An apparatus as claimed in Claim 3, characterised in that the said retention means for each plate-shaped extraction head (17) comprises a hole or seat through the said plate-shaped extraction head for each thermoformed article to be extracted, each hole being machined along its thickness to obtain two annular surfaces reamed in opposite directions and delimiting between them an equatorial shoulder (16d) with a slightly undercut, internal angle of incidence, in order to allow insertion by the thrust of a rimmed thermoformed article (15) and enable it to be resiliently constrained and held firmly in position at its rim.

5. A thermoforming apparatus as claimed in Claim 2, characterized in that it comprises a chain or chains conveyor (24) each wound by a pair of chain wheels and having a run (27) thereof extending along the respective die (12) or counter-die (13) but beyond the encumbrance thereof, a plurality of extraction plates (16) carried at predetermined intervals from each other on the said conveyor (24) and each fitted with the said retention means for retaining the thermoformed articles (15) in the proper set during their conveyance.

6. A thermoforming apparatus as claimed in Claim 1 or 2, characterized in that it comprises a template conveyor (24) extending through the work or treatment station or stations and moving stepwise at the opening-closure rate of the dies (12) for receiving a moulding or thermoformed articles (15) from an extraction plate (16) and conveying them in sequence to the work or treatment station or stations along the template conveyor (24).

7. A thermoforming apparatus as claimed in Claim 6, characterized in that the said template conveyor (24)

comprises two alternately movable templates (17), once on one side of the die (12) and once on the other, so that a template (17) is moved laterally in relation to the female die (12) at a work or treatment station, while the other one is in front of it to receive an article moulding from the extraction plate (16).

8. A thermoforming apparatus as claimed in Claim 6, characterized in that the said template conveyor (24) is a chain or chains conveyor which comprises a pair of chain wheels (26) around which the or a respective chain (25) is wound, a plurality of plate-like templates (17) carried, spaced at a predetermined distance from each other, on the said conveyor (24) and each fitted with the said retention means for retaining the thermoformed articles (15) in the proper set during their conveyance.

9. A thermoforming apparatus as claimed in Claim 5, characterized in that the said template conveyor (24) comprises a train of articulated bearing slides (32) or carriages (33) for a respective template (17) moving through the work or treatment station or stations.

10. A thermoforming apparatus as claimed in any of Claims 6 to 9, characterised in that the said retention means on each template comprises a truncated conical collar (38) seated in each receiving hole for precise location of a respective thermoformed article (15) on the surface of each template (17) facing the extraction plate of plates (16).

11. A thermoforming apparatus as claimed in Claim 10, characterised in that the said collar (38) is constituted of resiliently deformable material suitable for exercising a moderate retentive pressure on the external surface of a thermoformed article (15).

12. A thermoforming apparatus as claimed in Claim 10, characterised in that the said collar (38) comprises a

plurality of resiliently loaded ratchets (48), installed in said collar and movable towards its internal diameter for engaging with the external surface of a thermoformed article (15) in a respective receiving seat.

5

13. A thermoforming apparatus as claimed in Claim 10, characterised in that the said collar (38) comprises suction orifices which exert on the thermoformed article (15) a suction action to hold it in the proper set in its
10 respective receiving seat and with its rim abutting against the template (17).

15

14. A thermoforming apparatus as claimed in any of Claims 10 to 13, characterised in that each template (17) at each flanged receiving set for thermoformed rimmed articles (15) has a peripheral recess formed on the surface of the
template (17) facing the extraction plate or plates (16) for engaging the rim of a respective article (15) installed in it.

20

15. A thermoforming apparatus as claimed in any of Claims 6 to 9, characterised in that the said retention means for each template (17) comprises a two-diameter adaptor collar (39) installable in each receiving seat and having an
25 internal diameter delimited by a tapered under section, and undercut intermediate section with a negative angle α , an annular shoulder downstream of the undercut section, to be able to receive from above a flanged thermoformed article (15) and snap-engage its rim at its undercut.

30

16. A thermoforming apparatus as claimed in any of Claims 6 to 9, characterised in that the said retention means for each template (17) comprises receiving holes for the
thermoformed articles lower portion, but with a slightly
35 smaller internal diameter than the external dimensions of the thermoformed articles (15) to be received close to its rim, so that the thermoformed article (15) is resiliently

constrained and then steadily bedded in the respective receiving hole.

17. A thermoforming apparatus as claimed in any of Claims 6 to 9, characterised in that the said retention means of each template (17) comprises eccentric mechanical arrests (50), each of which is fitted at a respective receiving hole of a template (17) and is movable between an operating position in which it engages the rim of a flanged thermoformed article (15) and an inoperative releasing position.

18. A thermoforming apparatus as claimed in Claim 17, characterised in that the said arrests are controlled by a rack operated by a suitable motion source.

19. A thermoforming apparatus as claimed in any of Claims 6 to 9, characterised in that the said retention means comprises air jets (53) for sinking each of the articles (15) into the receiving holes on each template (17).

20. A thermoforming apparatus as claimed in any of Claims 6 to 9, characterised in that the said retention means comprises a cup-shaped receiving component (54, 61) for a thermoformed article (15) having at least one orifice in its base.

21. A thermoforming apparatus as claimed in Claim 21, characterised in that it comprises a push rod (56) for expelling the thermoformed article (15) from the cup-shaped component (54, 61) by acting through at least one orifice (55) in the bottom of the cup-shaped component.

22. A thermoforming apparatus as claimed in any one of Claims 6 to 9, characterised in that the said retention means comprises a support shoulder for shallow, thermoformed articles arranged between each receiving seat of the template (17), the said shoulder having two diameters or

else including an annular projection which engages the internal diameter of the rim of the article.

5 23. A thermoforming apparatus as claimed in any of Claims 6 to 9, characterised in that the said retention means comprises a push-rod which rises from a surface of each template (17) to a respective dummy receiving seat.

10 24. A thermoforming apparatus as claimed in any of Claims 6 to 9, characterised in that the said retention means comprises at least one annular recess, in which the free rim of an upturned hollow article (15) abuts and a movable push road (56) for removal of the article (15).

00009340-050697
459050-04650380

Applicant or Patentee: Pietro Padovani Attorney's Docket No.: B-3289PCT 615920-5
 Serial or Patent No.: 08/809,340
 Filed or Issued: _____
 For: "THERMOFORMING APPARATUS FOR THERMOFORMABLE MATERIALS IN RIBBON OR SHEET-FORM"
 International Appln. No. PCT/EP95/03451 - Filed: September 1, 1995

VERIFIED STATEMENT (DECLARATION) CLAIMING SMALL ENTITY STATUS
37 CFR 1.9(F) AND 1.27(C) - SMALL BUSINESS CONCERN

I hereby declare that I am:

☐ the owner of the small business concern identified below:

☒ an official of the small business concern empowered to act on behalf of the concern identified below:

Name of Concern: ISAP OMV GROUP SPA

Address of Concern: Via Lungadige Attiraglio, 67, 1-37025 Parona, Italy

I hereby declare that the above identified small business concern qualifies as a small business concern as defined in 13 CFR 121.3-18, and reproduced in 37 CFR 1.9(d), for purposes of paying reduced fees under Section 41(a) and (b) of Title 35, United States Code, in that the number of employees of the concern, including those of its affiliates, does not exceed 500 persons. For purposes of this statement, (1) the number of employees of the business concern is the average over the previous fiscal year of the concern of the persons employed on a full-time, part-time or temporary basis during each of the pay periods of the fiscal year, and (2) concerns are affiliates of each other when either, directly or indirectly, one concern controls or has the power to control the other, or a third party or parties controls or has the power to control both.

I hereby declare that rights under contract or law have been conveyed to and remain with the small business concern identified above with regard to the invention, entitled: "THERMOFORMING APPARATUS FOR THERMOFORMABLE MATERIALS IN RIBBON OR SHEET-FORM"

by inventor(s): Pietro Padovani

described in:

☐ the specification filed herewith.

☐ application serial no.: _____, filed _____.

☐ patent no. _____, issued _____.

☒ International Appln. No. PCT/EP95/03451, filed 09/01/95

If the rights held by the above identified small business concern are not exclusive, each individual, concern or organization having rights to the invention is listed below*, and no rights to the invention are held by any person, other than the inventor, who could not qualify as a small business concern under 37 CFR 1.9(c) or by any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a non-profit organization under 37 CFR 1.9(e).

*NOTE: Separate verified statements are required from each named person, concern or organization having rights to the invention averring to their status as small entities. (37 CFR 1.27)

NAME: _____

ADDRESS _____

☐ INDIVIDUAL ☐ SMALL BUSINESS CONCERN ☐ NONPROFIT ORGANIZATION

NAME: _____

ADDRESS _____

☐ INDIVIDUAL ☐ SMALL BUSINESS CONCERN ☐ NONPROFIT ORGANIZATION

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. [37 CFR 1.28(b)]

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

Name of Person Signing: Dr. Pietro Padovani

Title of Person Other Than Owner: PRESIDENT of ISAP OMV GROUP SPA

Address of Person Signing: via Carlo Ederle, 43- 37126 VERONA (Italy)

Signature: *Pietro Padovani*

Date: 18TH APRIL, 1997

08809340 050697

For: "THERMOFORMING APPARATUS FOR THERMOFORMABLE MATERIALS IN RIBBON OR SHEET-FORM"

VERIFIED STATEMENT (DECLARATION) CLAIMING SMALL ENTITY STATUS (37 CFR 1.9 (f) and 1.27(b)) – INDEPENDENT INVENTOR(S)

described in

- [X] International Appln. No. PCT/EP95/03451, filed 09/01/95

Each person, concern or organization to which I have assigned, granted, conveyed or licensed or am under an obligation under contract or law to assign, grant, convey or license any rights in the invention is listed below:

- *NOTE: Separate verified statements are required from each named person, concern or organization having rights to the invention averring to their status as small entities. (37 CFR 1.27)

ADDRESS Via Lungadige Attiraglio, 67, 1-37025 Parona, Italy

☐ INDIVIDUAL ☒ SMALL BUSINESS CONCERN ☐ NONPROFIT ORGANIZATION

ADDRESS _____

☐ INDIVIDUAL ☐ SMALL BUSINESS CONCERN ☐ NONPROFIT ORGANIZATION

ADDRESS _____

☐ INDIVIDUAL ☐ SMALL BUSINESS CONCERN ☐ NONPROFIT ORGANIZATION

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

18TH APRIL, 1997
Date

Date _____

Date _____

PATENT

Attorney's Docket No. B-3289 PCT 615920-5**COMBINED DECLARATION AND POWER OF ATTORNEY***(ORIGINAL, DESIGN, NATIONAL STAGE OF PCT, SUPPLEMENTAL, DIVISIONAL, CONTINUATION OR CIP)*

As a below named inventor, I hereby declare that:

TYPE OF DECLARATIONThis declaration is of the following type: *(check one applicable item below)*

- ☒ original
☐ design
☐ supplemental

NOTE: *If the declaration is for an International Application being filed as a divisional, continuation or continuation-in-part application do not check next item; check appropriate one of last three items.*

- ☒ national stage of PCT

NOTE: *If one of the following 3 items apply then complete and also attach ADDED PAGES FOR DIVISIONAL, CONTINUATION OR CIP.*

- ☐ divisional
☐ continuation
☐ continuation-in-part (CIP)

INVENTORSHIP IDENTIFICATION

WARNING: *If the inventors are each not the inventors of all the claims an explanation of the facts, including the ownership of all the claims at the time the last claimed invention was made, should be submitted.*

My residence, post office address and citizenship are as stated below next to my name, I believe I am the original, first and sole inventor *(if only one name is listed below)* or an original, first and joint inventor *(if plural names are listed below)* of the subject matter which is claimed and for which a patent is sought on the invention entitled:

TITLE OF INVENTION"THERMOFORMING APPARATUS FOR THERMOFORMABLE MATERIALS IN RIBBON OR SHEET-FORM"**SPECIFICATION IDENTIFICATION**the specification of which: *(complete (a), (b) or (c))*

- (a) ☐ is attached hereto.
 (b) ☐ was filed on _____ as ☐ Serial No. 0 / _____
 or ☐ Express Mail No., as Serial No. not yet known _____
 and was amended on _____ *(if applicable)*.

NOTE: *Amendments filed after the original papers are deposited with the PTO which contain new matter are not accorded a filing date by being referred to in the declaration. Accordingly, the amendments involved are those filed with the application papers or, in the case of a supplemental declaration, are those amendments claiming matter not encompassed in the original statement of invention or claims. See 37 CFR 1.67.*

- (c) ☒ was described and claimed in PCT International Application No. PCT/EP95/03451 filed on 01 September 1995 and as amended under PCT Article 19 on _____ *(if any)*.

ACKNOWLEDGEMENT OF REVIEW OF PAPERS AND DUTY OF CANDOR

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code Federal Regulations § 1.56.

[] In compliance with this duty there is attached an information disclosure statement 37 CFR 1.97.

PRIORITY CLAIM

I hereby claim foreign priority benefits under Title 35, United States Code, § 119 of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign applications(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed.

(complete (d) or (e))

- (d) [] no such applications have been filed.
(e) [X] such applications have been filed as follows.

NOTE: Where item (c) is entered above and the International Application which designated the U.S. claimed priority check item (e), enter the details below and make the priority claim.

**EARLIEST FOREIGN APPLICATION(S), IF ANY, FILED WITHIN 12 MONTHS
(6 MONTHS FOR DESIGN(S)) PRIOR TO THIS U.S. APPLICATION**

COUNTRY	APPLICATION NUMBER	DATE OF FILING (day, month, year)	PRIORITY CLAIMED UNDER 37 USC 119
Italy	VR94A000082	14 September 1994	[X] YES [] NO
			[] YES [] NO
			[] YES [] NO
			[] YES [] NO
			[] YES [] NO

**ALL FOREIGN APPLICATION(S), IF ANY FILED MORE THAN 12 MONTHS
(6 MONTHS FOR DESIGN(S)) PRIOR TO THIS U.S. APPLICATION**

POWER OF ATTORNEY

As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. (List name and registration number)

Richard P. Berg, Reg. No. 28,145

Colin P. Abrahams, Reg. No. 32,393

Mavis S. Gallenson, Reg. No. 32,464

Kam C. Louie, Reg. No. 33,008

Don A. Hollingsworth, Reg. No. 25,631

Ira M. Siegel, Reg. No. 28,907

Richard J. Paciulan, Reg. No. 28,248

John Palmer, Reg. No. 36,885

(check the following item, if applicable)

☐ Attached as part of this declaration and power of attorney is the authorization of the above-named attorney(s) to accept and follow instructions from my representative(s).

SEND CORRESPONDENCE TO:

Richard P. Berg

c/o LADAS & PARRY

5670 Wilshire Boulevard, Suite 2100

Los Angeles, California 90036-5679

DIRECT TELEPHONE CALLS TO:

Richard P. Berg

(213) 934-2300

DECLARATION

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

SIGNATURE(S)

Full name of sole or first inventor Pietro Padovani

Inventor's signature *Pietro Padovani*

Date X 18TH APRIL, 1997 Country of Citizenship Italy

Residence Verona, Italy

Post Office Address Via Carlo Ederle, 43

1-37100 Verona, Italy

Full name of second joint inventor, if any _____

Inventor's signature _____

Date _____ Country of Citizenship _____

Residence _____

Post Office Address _____

**CHECK PROPER BOX(ES) FOR ANY OF THE FOLLOWING ADDED PAGES(S)
WHICH FORM A PART OF THIS DECLARATION**

- ☐ Signature for third and subsequent joint inventors. *Number of pages added* _____
- ☐ Signature by administrator(trix), executor(trix) or legal representative for deceased or incapacitated inventor. *Number of pages added* _____
- ☐ Signature for inventor who refuses to sign or cannot be reached by person authorized under 37 CFR 1.47. *Number of pages added* _____

- ☐ Added pages to combined declaration and power of attorney for divisional, continuation-in-part (CIP) application.

☐ *Number of pages added* _____

- ☐ Authorization of attorney(s) to accept and follow instructions from representative.

If no further pages form a part of this Declaration then end this Declaration with this page and check the following item.

☒ This declaration ends with this page.

FIG. 1

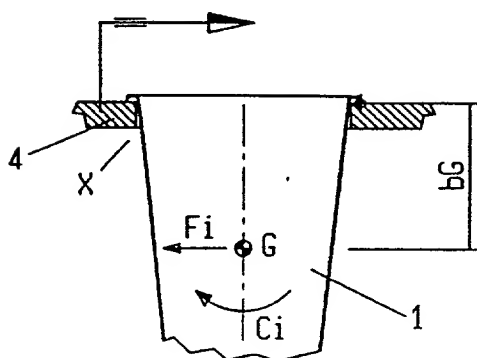


FIG. 2

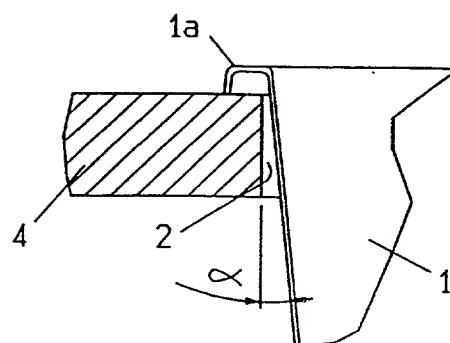


FIG. 3

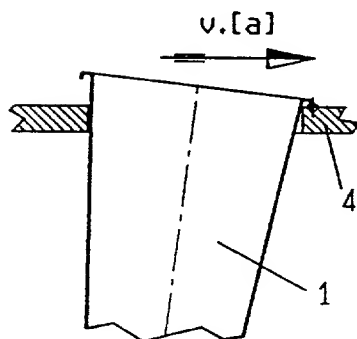


FIG. 4

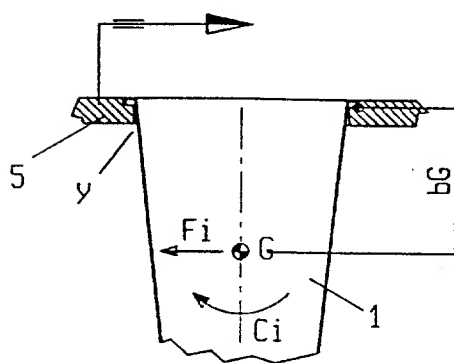


FIG. 5

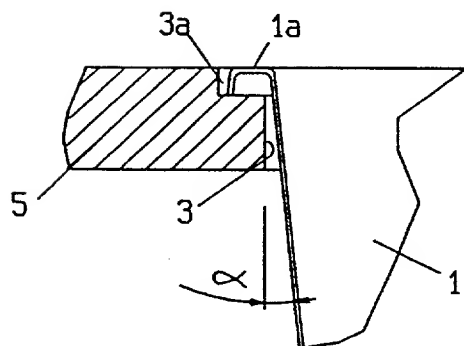
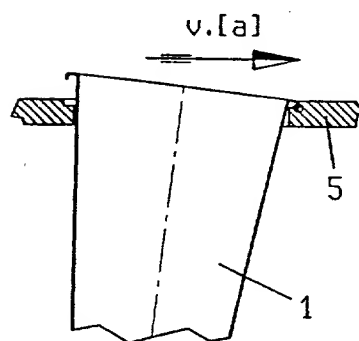
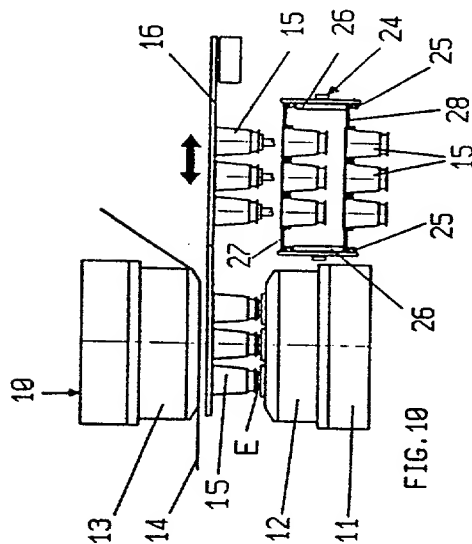
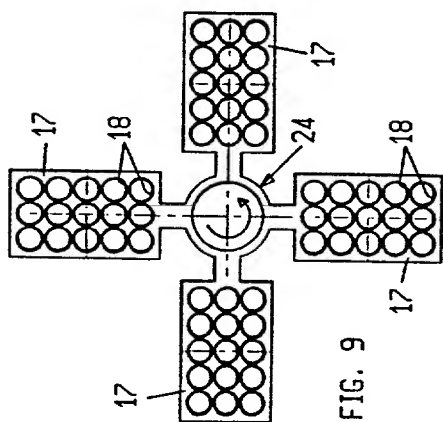
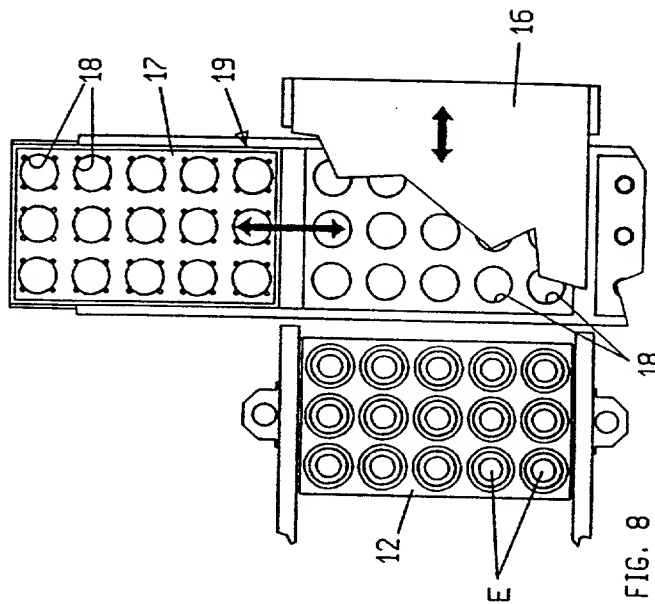
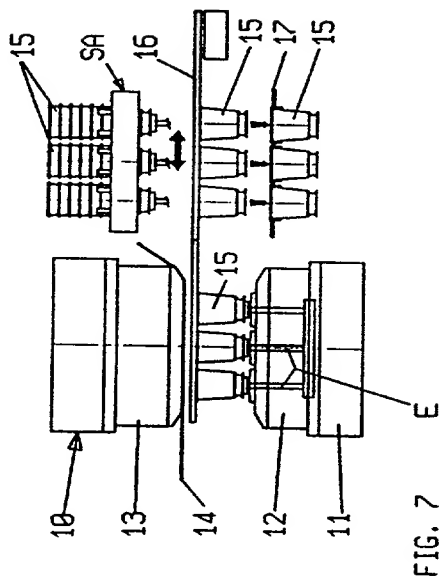


FIG. 6





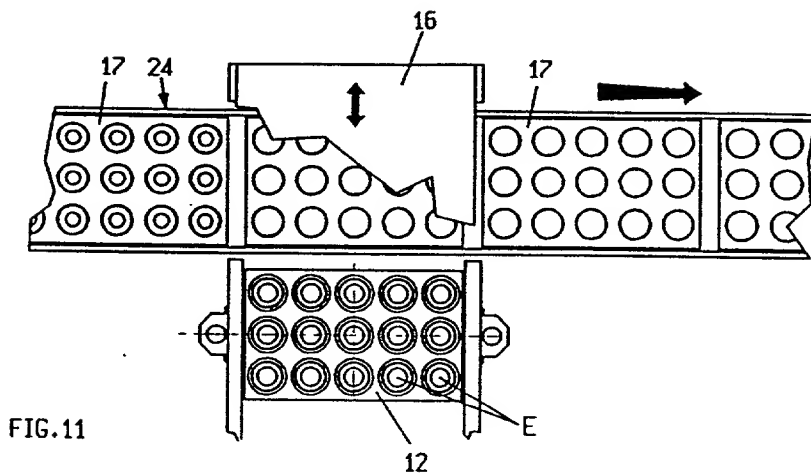


FIG. 11

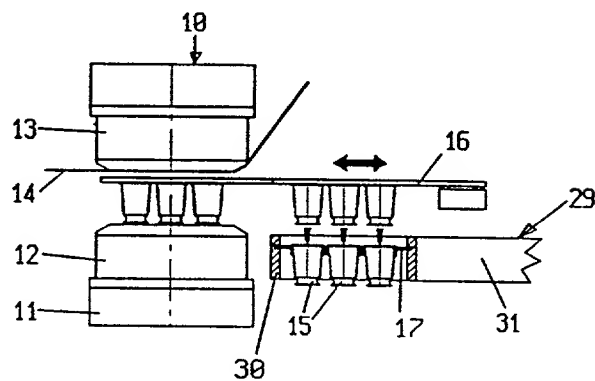


FIG. 12

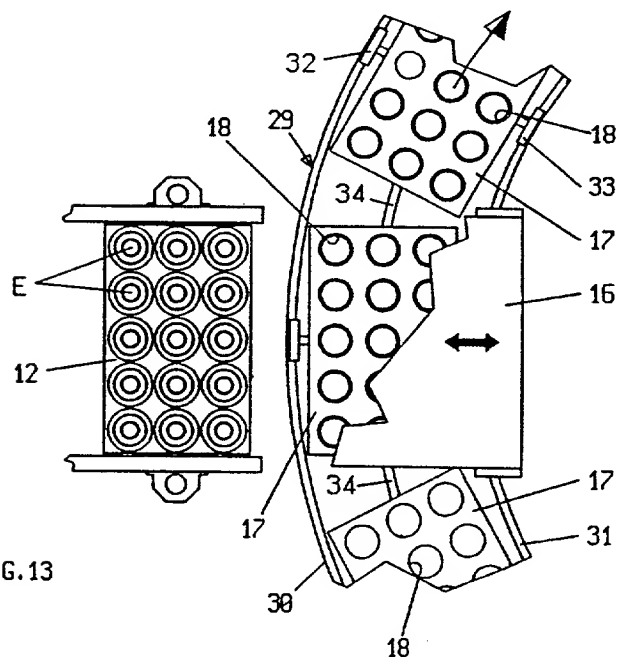


FIG. 13

FIG. 17

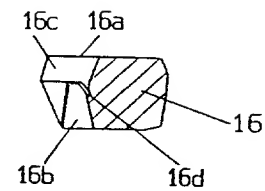
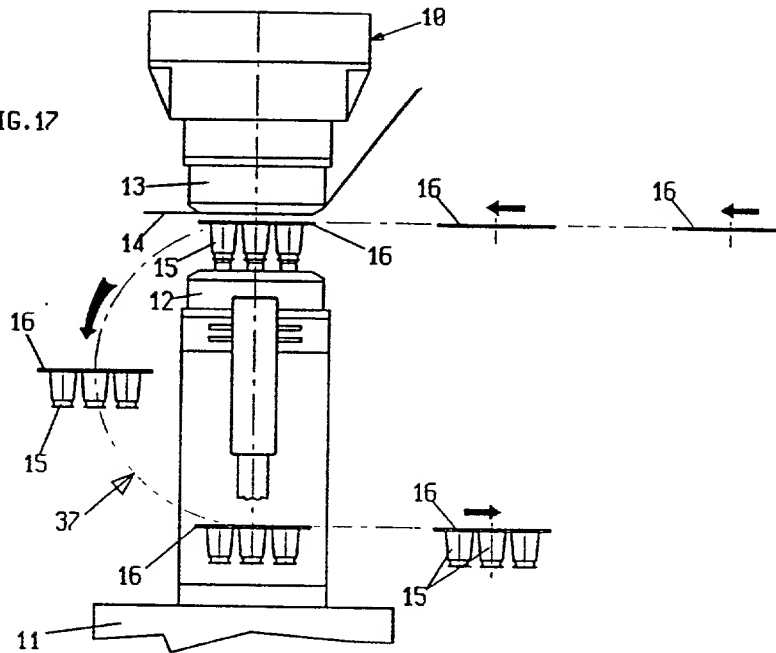


FIG. 18

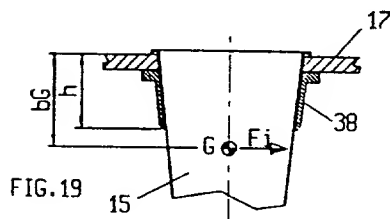


FIG. 19

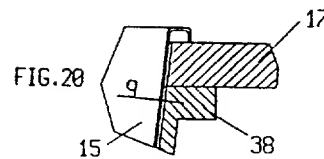


FIG. 20

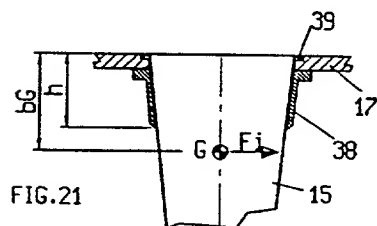


FIG. 21

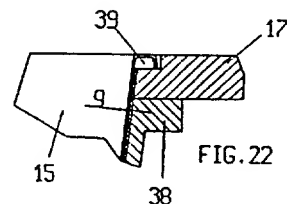


FIG. 22

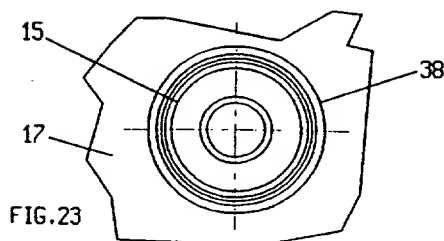


FIG. 23

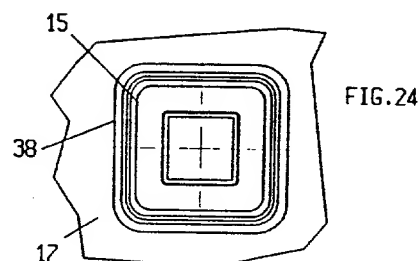


FIG. 24

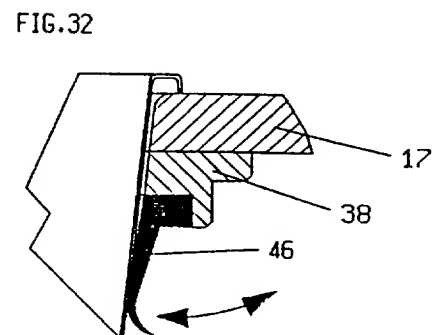
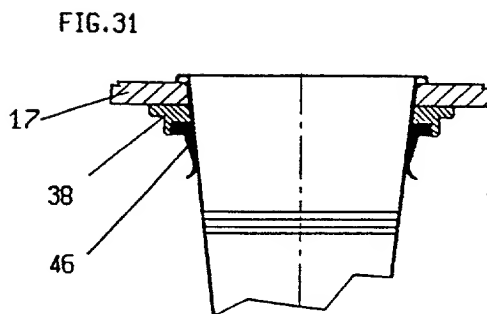
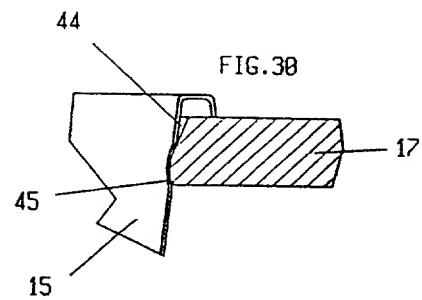
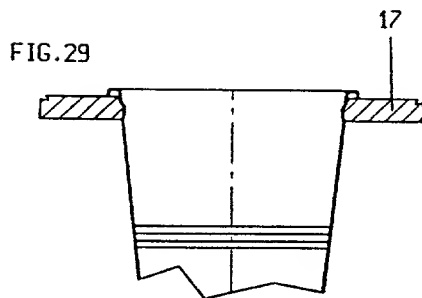
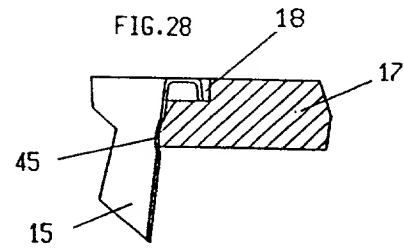
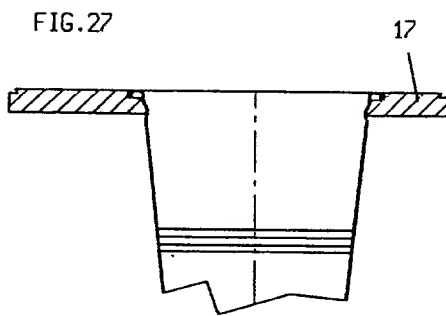
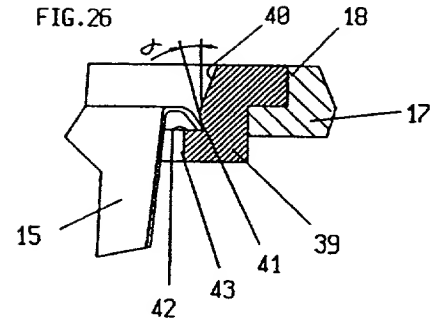
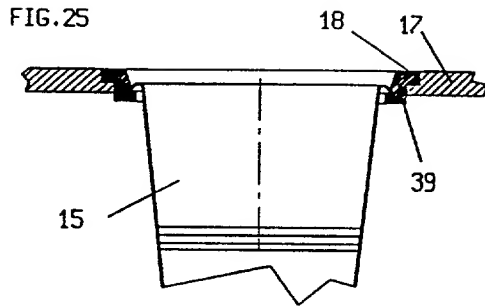


FIG.33

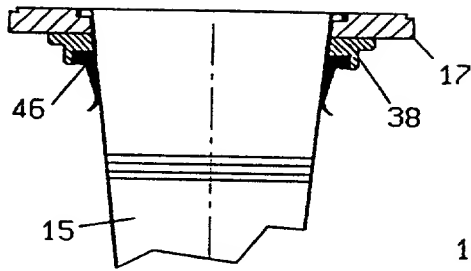


FIG.34

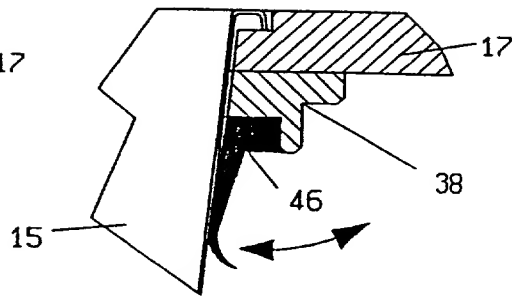


FIG.35

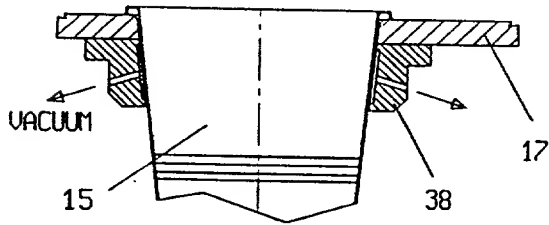


FIG.36

